

## ABSTRACT

A horizontal bore cryogenic drilling method includes in a first embodiment forming a pilot hole of a first select diameter along a desired path of the horizontal bore. A grindable casing is inserted into the guide bore. A cryogenic fluid is flowed through the grindable casing to form a freeze zone of frozen moisture adjacent the grindable casing having a second select diameter. A primary bore is formed having a third select diameter greater than the first diameter and less than the second select diameter within the freeze zone along the desired path of the horizontal bore with the grindable casing in place. The second diameter is selected to be sufficiently greater than the third select diameter to prevent collapse of the freeze zone. Another embodiment of the invention is a method of forming a horizontal bore in an earth formation including providing a drill string having a conduit communicating with a cutting tool for engaging the earth formation. A cryogenic fluid is flowed through the conduit and the cutting tool to drive the cutting tool and remove cuttings from a bore formed by the cutting tool. The cutting tool is directed into an earth formation and a freeze zone is formed in the earth formation in advance of the cutting tool by the cryogenic fluid flowing through the cutting tool. The cutting tool is then advanced into the earth formation to form the horizontal bore at a rate enabling continuous formation of a freeze zone in advance of the cutting tool of sufficient diameter to prevent collapse of the bore as the cutting tool is advanced.

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